

Review of the *mandibularis* group of the genus *Dolichomitus* (Hymenoptera, Ichneumonidae, Pimplinae)

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Abstract

The *mandibularis* group of the genus *Dolichomitus* is reviewed. Three species are recognized, including a new species, *Dolichomitus flavicrus* **sp. n.** from Japan. The new species is closely related to *Dolichomitus khasianus* Gupta & Tikar, in having an entirely blackish underside of the metasoma, but can be separated from the latter by the smooth antero-median part of the first metasomal tergite between the latero-median carinae and a short longitudinal dark stripe on the posterior surface of the fore femur. A key to species of the *mandibularis* group is provided. Mitochondrial COI gene sequences were generated for *D. mandibularis* (Uchida) and *D. flavicrus* **sp. n.** to permit future comparisons.

Keywords

new species, Japan, description, parasitoid, *Pterocarya*, borer

Introduction

Dolichomitus Smith is a relatively large genus containing more than seventy species predominantly distributed in the Holarctic region but also extending to the Oriental and Neotropical regions (Gauld 1990, Yu et al. 2011). The *mandibularis* group, first recognized by Gupta and Tikar (1976), is one of the 9 species groups of the genus (Townes and Townes 1960, Gupta and Tikar 1976, Gauld 1991), characterized by the medially strongly bent mandibles with a shorter lower tooth. Two species of this group have

been known, viz., *Dolichomitius khasianus* Gupta & Tikar from India and *Dolichomitius mandibularis* (Uchida) from Japan. Recently an additional species was discovered in Honshu, Japan and it turned out to be new to science through comparison with the types of known species.

Materials and methods

Both the holotypes of *Dolichomitius mandibularis* and *Dolichomitius khasianus* were borrowed from the Laboratory of Systematic Entomology, Hokkaido University, Japan (**SEHU**), and Zoologische Staatssammlung München, Germany (**ZSM**), respectively. The type specimens of the new species and other specimens examined are preserved in the collection of Osaka Museum of Natural History (**OMNH**) except for one paratype in the Natural History Museum, London (**BMNH**). External structures of specimens were observed under a stereomicroscope (Nikon SMZ-800) and KEYENCE VHX-1000 digital microscope. Figures were prepared using the focus stacking function (combining several partially focused images) of the latter and the high resolution shot function of an Olympus E-M5 Mark II digital camera with 60 mm macro lens. See Matsumoto (2016) for DNA extraction, PCR and sequencing protocols. The INSD accession numbers for each sequence are mentioned in the specimens examined section. Terminology of adult morphology follows Gauld (1991).

Taxonomy

The *mandibularis* group of the genus *Dolichomitius*

The main recognition characters of the genus *Dolichomitius* are: tip of lower valve of ovipositor with a dorsal lobe that partially encloses tip of upper valve; dorsally complete occipital carina; T2 with basal oblique groove longitudinal rather than transverse; vein Rs+M of fore wing opposite vein cu-a; vein Cu1 of hind wing separated from M by less than 1.0× length of cu-a; upper tooth of mandible as long as lower tooth or longer (in *mandibularis* group and in some other species).

Among members of the genus *Dolichomitius*, the *mandibularis* group can easily be distinguished by the medially strongly bent mandibles (Fig. 1a).

Dolichomitius flavicrus Matsumoto, sp. n.

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Figs 1a–d, f, h, 2, 3

Description. Female. Head (Fig. 1a). Antennal flagellum with 40–41 segments; face densely covered with pubescence, between antennal socket and supraclypeal suture 0.5×

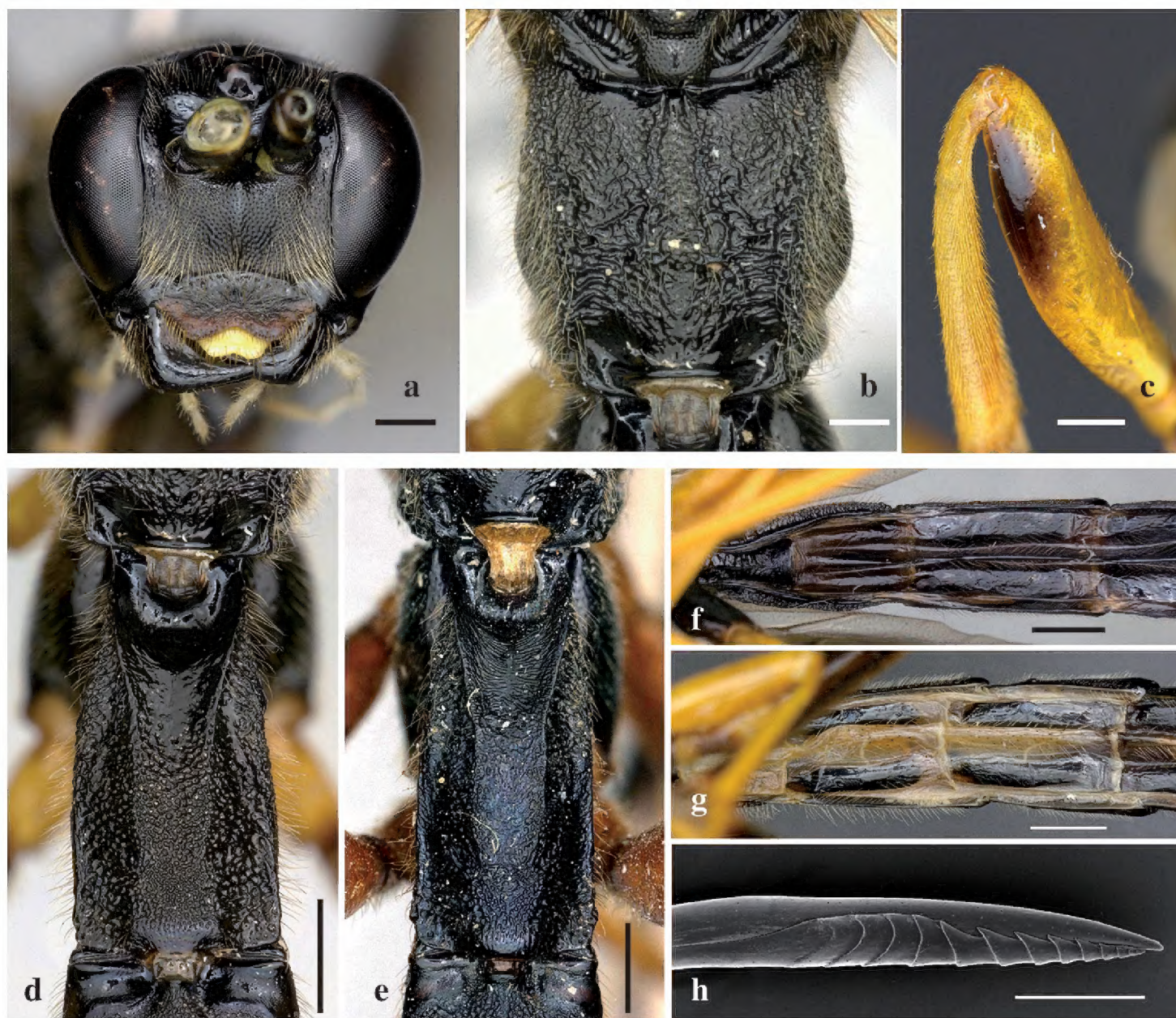


Figure 1. *Dolichomit* species of the *mandibularis* group: **a–d, f, h** *D. flavicrus* sp. n. (paratype) **e** *D. khasianus* (Holotype) **g** *D. mandibularis* **a** head in frontal aspect **b** propodeum in dorsal aspect **c** fore femur in posterior aspect **d, e** first metasomal tergite in dorsal aspect **f, g** first to third metasomal segments in ventral aspect **h** ovipositor tip in lateral aspect. Scale bars: 0.5mm (**a, b, c, h**); 1mm (**d, e, f, g**).

as long as its minimum width between eyes; clypeus flat, about 2.3× as wide as high, with apical margin bilobed, deeply incised medially; distance between eye and lateral ocellus 1.5× as long as maximum diameter of latter; mandible moderately tapered, at middle about 0.5× as wide as basal width; malar space about 0.3× basal width of mandible; vertex with inter-ocellar area weakly raised; outline of gena moderately rounded in dorsal view.

Mesosoma. Pronotum with anterior edge incised medially, medially thickened to form a posteriorly directed tooth, followed by median longitudinal groove reaching to posterior margin; epomia curved, lower end turning backwards; mesoscutum in front of scuto-scutellar groove 1.5–1.6× as long as wide in dorsal view, covered with moderately dense pubescence; mesopleuron moderately punctate and pubescent, with area below episternal scrobe moderately depressed, mesopleural suture distinctly foveolate, below episternal scrobe, foveae indistinct above episternal scrobe; scutellum moderately convex; metapleuron moderately convex medially, entirely reticulate-ru-

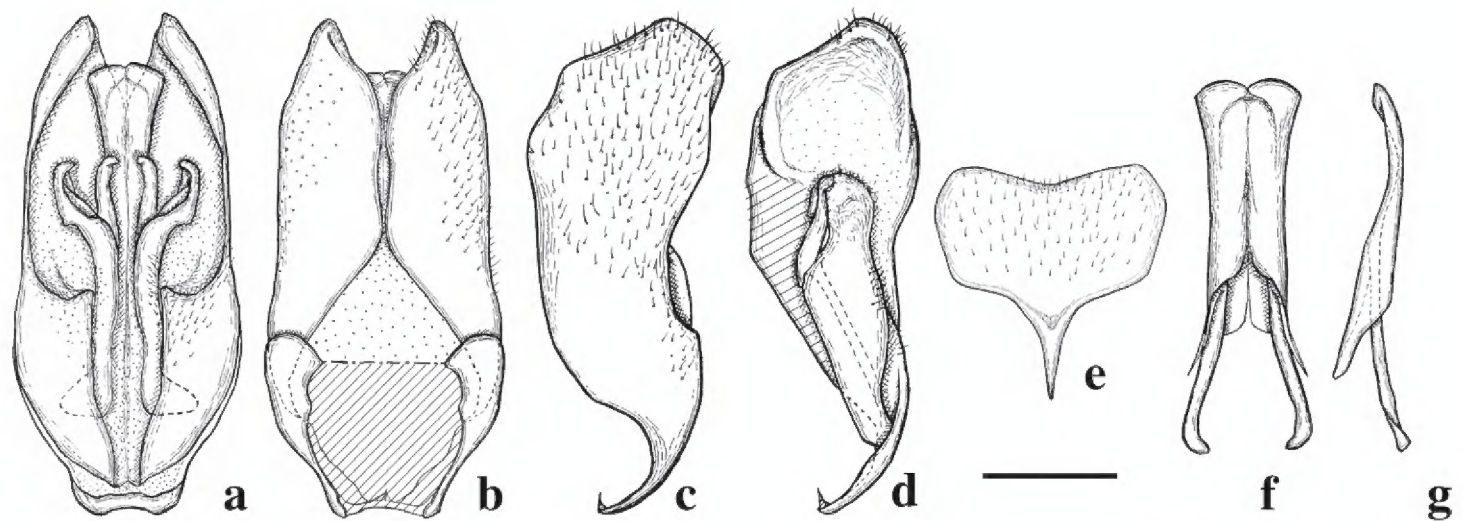


Figure 2. Male genitalia of *D. flavicrus* sp. n. (paratype): **a** ventral aspect **b** dorsal aspect **c** paramere, lateral aspect **d** paramere, inner aspect **e** subgenital plate, ventral aspect **f** aedeagus, ventral aspect **g** aedeagus, lateral aspect. Scale bar: 1 mm.

gose; propodeum (Fig. 1b) entirely reticulate-rugose, moderately densely covered with pubescence, with lateromedian longitudinal carinae present from base to middle, almost replaced by wrinkles; lateral longitudinal carina indistinct anteriorly, replaced by rugosity; submetapleural carina distinct, posteriorly fused with fine ventral transverse wrinkles in front of each hind coxal cavity.

Wings (Fig. 3a). Fore wing with vein Rs+M opposite cu-a; 2rs-m as long as 3rs-m, slightly shorter than vein M between 2rs-m and 2m-cu; vein M between 3rs-m and 2m-cu about 0.2× length of M between 2rs-m and 2m-cu, vein Cu1a separated from 1m-cu by about 1.2× length of Cu1b; vein cu-a weakly inclivous. Hind wing with vein M+Cu almost straight; distal abscissa of Cu1 present, reaching wing margin; vein Cu1 separated from M by 0.5× length of cu-a; vein cu-a reclivous to vein 1A.

Legs. Fore femur moderately inflated, 4.3–4.4× as long as wide; hind femur moderately stout, about 4× as long as its maximum width; hind tibia about 10.5× as long as its apical width; first tarsal segment of hind leg slightly longer than second and third segments combined; fifth segment about as long as second.

Metasoma. First metasomal tergite (Fig. 1d) with median longitudinal carinae distinct, moderately convergent posteriorly in dorsal view, extending to 0.5 of T1; median part between median longitudinal carinae strongly raised posteriorly, with median basal depression nearly smooth, densely puncto-reticulate posteriorly, lateral surface rugose; posterior half of lateral longitudinal carina distinct; spiracle situated at basal 0.35 of T1, slightly below level of lateral carina, encircled by deep oblong groove; T2 with antero-lateral corners strongly impressed in front of pair of antero-lateral oblique grooves; central area of T2 strongly raised, with punctures very dense on dorsal surface and rather sparse laterally. First metasomal tergite 2.0× as long as its apical width; T2 about 1.1× as long as T1 and about 1.5× as long as its apical width. Ovipositor very long, about 70 mm, projecting beyond apex of metasoma by 10.0× length of hind tibia; ovipositor with expanded area of lower valve bearing 5 grooves,

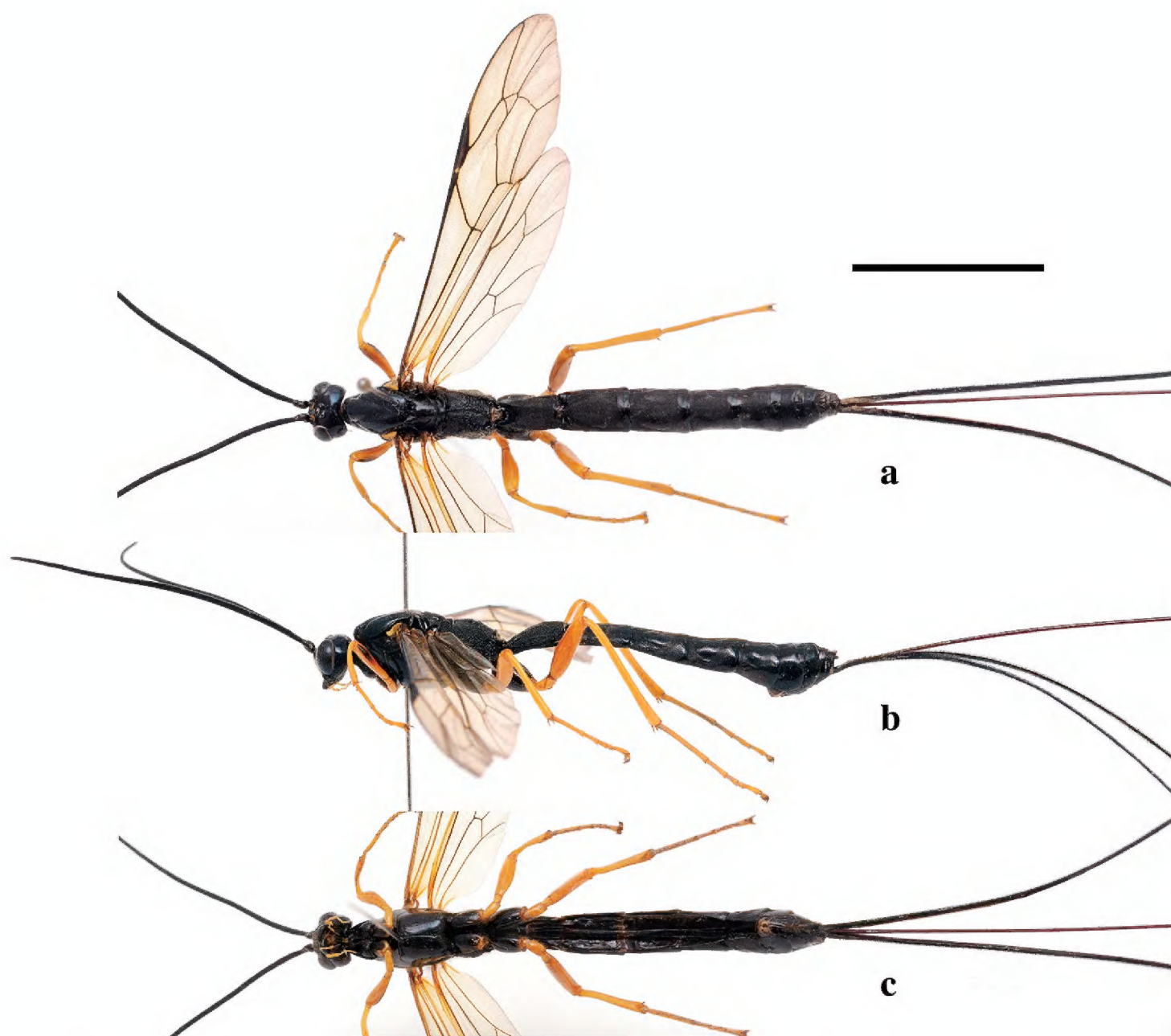


Figure 3. Holotype female of *D. flavicrus* sp. n.: **a** dorsal aspect **b** lateral aspect **c** ventral aspect. Scale bar: 10 mm.

the most proximal 4 of which are reclivous, followed by apical 7 teeth (Fig. 1h); ovipositor sheath bearing short setae which are about $1.1\times$ as long as width of sheath.

Coloration. Head, mesosoma and metasoma including mesosternum and membranous area between sclerites black (Figs 1f, 3c); lower half of clypeus tinged with reddish brown (Fig. 1a); labrum, maxillary and labial palpi yellow. Tegula and parategula yellow. Wings weakly tinged with yellowish brown, slightly darkened along distal margin. Legs largely vivid yellow, except for black coxae, short longitudinal dark stripe on posterior surface of fore femur (Fig. 1c) and dark brown tip of tarsal claw.

Male. Very similar to female in morphology and colouration. Flagellum with 40 segments. Genitalia as in Fig. 2; subgenital plate (Fig. 2e) transverse, moderately covered with short pubescence, weakly incised at the middle, posteriorly; paramere (Fig. 2c, d) moderately long, angular, with ventral margin concave, apical half of outer side bearing rather dense short pubescence; apex of distivolsella flat (Fig. 2d); gonolacinia slightly turned inwards (Fig. 2a); aedeagus (Fig. 2f, g) stout and flat, with lateral

sides almost parallel, slightly divergent toward apex; tip of aedeagus weakly incised at middle, laterally squarish.

Length. Fore wing 20–22 mm in ♀ (21 mm in holotype), 18 mm in ♂.

Type series. Holotype. ♀ (Fig. 3), pinned, 22. V. 2016, Akazai-keikoku (35.2149°N, 134.4936°E, (WGS 84), 510m a.s.l.), Shisou-shi, Hyogo Pref., Japan (Rikio Matsumoto), OMNH TI-522, DNA sample: OMNH_Pol-420, INSD accession number LC337798.

Paratypes. 2♀, same data as holotype; 1♂3♀, 11.VI.2001, same locality as holotype (1♀ in BMNH).

Distribution. Japan (Honshu).

Remarks. This species is closely related to *D. khasianus*, from which it can be separated by a short and longitudinal dark stripe on the posterior surface of the fore femur, less developed epomia and lack of fine transverse striations on the antero-median part of the first metasomal tergite between the latero-median carinae.

All known specimens were collected while flying around nearly dead *Pterocarya rhoifolia* Sieb. et Zucc trees (Juglandaceae). In several cases, females were observed investigating the trunk of the tree with their antennae and thrusting their ovipositors into it. A male was also observed flying around the trunk.

Etymology. The specific name refers to the golden yellow legs contrasting with the black mesosoma and metasoma.

Dolichomitius khasianus Gupta & Tikar

Figs 1e, 4

Dolichomitius khasianus Gupta & Tikar, 1976: 64.

Remarks. This species is closely related to *Dolichomitius flavicrus* sp. n. Fore and mid coxae black, femora, tibiae and tarsi of mid and hind legs entirely concolorous yellow to reddish yellow, underside of metasoma including mesosternum and membranous area between sclerites entirely blackish in these species. However this species can be distinguished from the latter by the lack of a dark stripe on the posterior surface of the fore femur and by fine and dense transverse striations on the antero-median part of the first metasomal tergite (Fig. 1e).

This species was described based on a single female from India. Sheng & Sun (2010) recorded *D. khasianus* from Yunnan in China.

Length. Fore wing 25 mm, ovipositor sheath 95 mm.

Male. Unknown.

Specimens examined. Holotype ♀ of *Dolichomitius khasianus* Gupta & Tikar (Fig. 4), “Khasia Hills, Assam, Athimus K.”, India (ZSM).

Distribution. India, China.

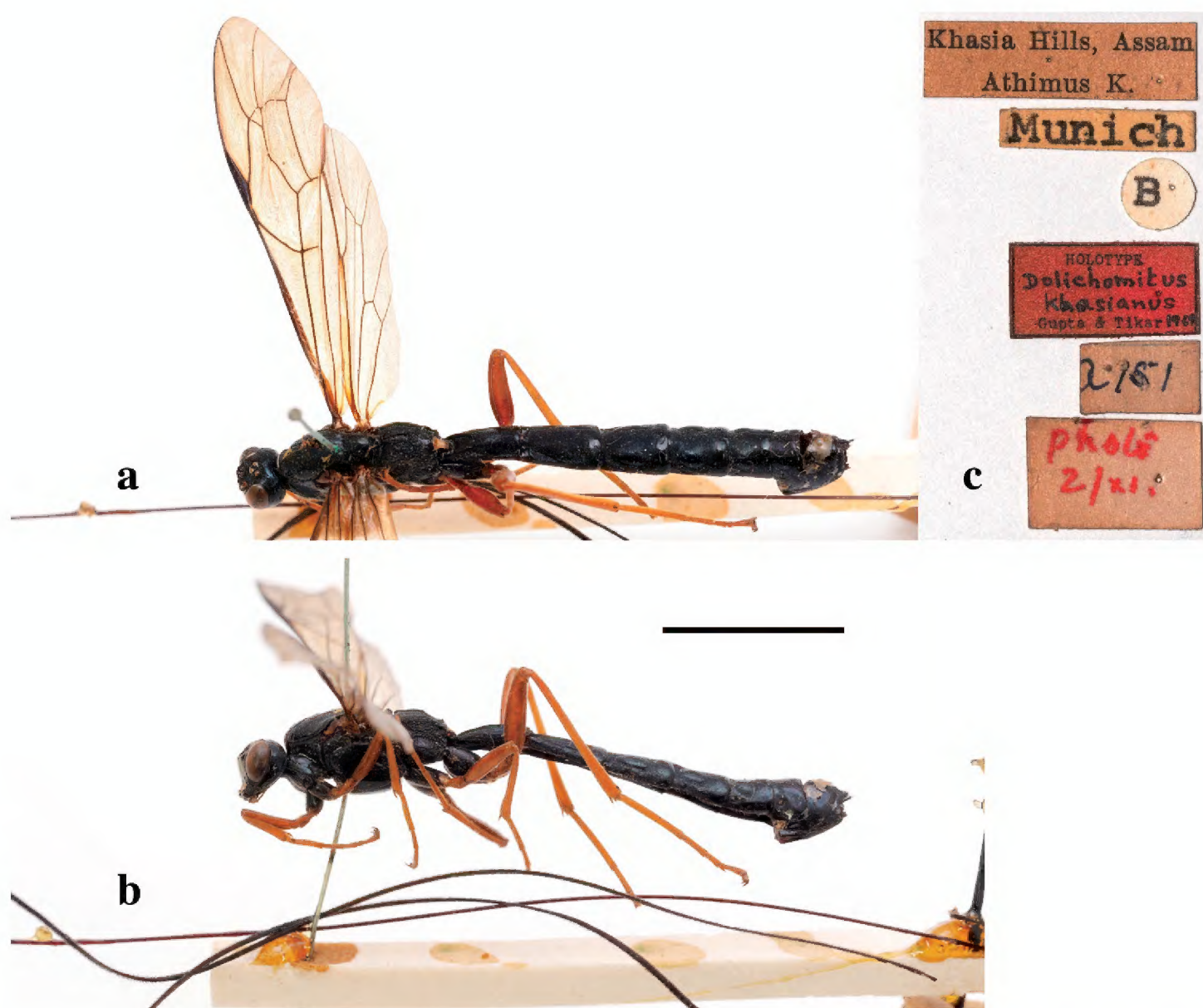


Figure 4. Holotype female of *D. khasianus*: **a** dorso-lateral aspect **b** lateral aspect **c** labels. Scale bar: 10 mm.

Dolichomit mandibularis (Uchida)

Figs 1g, 5

Ephialtes mandibularis Uchida, 1932: 160.

Dolichomit mandibularis: Townes, Momoi & Townes, 1965: 19.

Remarks. Relatively small species among members of the *mandibularis* group, with fore wing length 15mm or less. This species differs from *D. khasianus* and *D. flavicrus* sp. n. by the underside of the metasoma being not entirely blackish (Fig. 1g), with whitish membranous areas adjacent to sternites, and by its reddish fore and mid coxae (Fig. 5) and brown hind femur which is obviously darker than fore and mid femora (in the latter two species almost entirely yellow to reddish yellow).

Length. Fore wing 11–15mm in ♀, 11–13 mm in ♂.

Specimens examined. Holotype ♀ of *Ephialtes mandibularis* Uchida (Fig. 5), 1.VII.1929, Minoo, Osaka, (C.Teranishi) (SEHU); 6♂2♀, 2.V.2016, Byakugouji-cho,

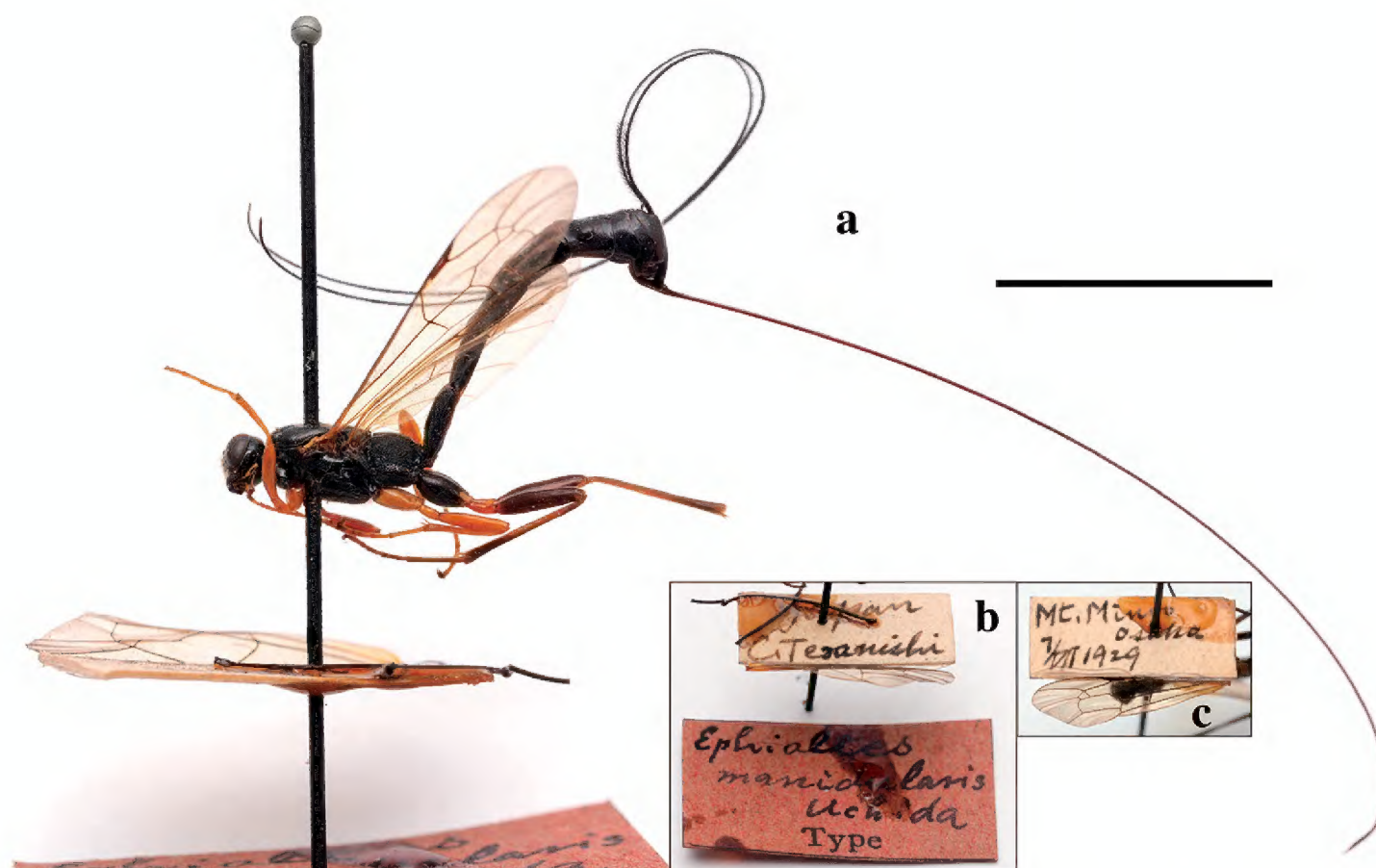


Figure 5. Holotype female of *D. mandibularis*: **a** lateral aspect **b** labels **c** underside of data label. Scale bar: 10 mm.

Nara-shi, Nara Pref. (R.M.), (1♂: DNA sample: OMNH_Pol-413, INSD accession number LC337797); 2♂, 7.V.2016, same locality, (R.M.); 2♀, 16.V.2016, same locality, (R.M.) (1♀ DNA sample: OMNH_Pol-384, INSD accession number LC337796); 1♀, 18.VI.2006, Mikusayama, Nose-shi, Osaka Pref., (R.M.); 1♀, 19.V.1941, Tsuyutani, Aoya-cho [Tottori-shi], Tottori Pref., (H. Aoki) ; 1♀, 17.VI.1953, Tottori Pref. (H. Aoki).

Distribution. Japan (Hokkaido, Honshu); China (Sheng and Sun 2002).

Remarks. All male specimens were collected while flying along a trunk of an unidentified dead deciduous tree.

Key to species of the *mandibularis* group of *Dolichomitus*

- 1 Mandible strongly bent at right angle in the middle (Fig.1a) *mandibularis* group...2
- Mandible weakly and evenly bent **other species groups**
- 2 Underside of metasoma blackish all over including membranous areas adjacent to sternites (Fig. 1f). Fore and mid coxae black (Figs 3b, c, 4b), hind femur yellow to reddish yellow, concolorous with fore and mid femora (Figs 3, 4). Larger species with fore wing 20 mm or more..... **3**
- Underside of metasoma not entirely blackish, with membranous areas adjacent to sternites whitish (Fig. 1g). Fore and mid coxae reddish yellow (Fig.

- 5), hind femur brown, obviously darker than fore and mid femora (Fig. 5).
 Smaller species with fore wing about 15 mm ***mandibularis***
- 3 Legs entirely reddish yellow except coxae (Fig. 4). Fore femur without dark
 stripe on posterior surface. Epomia developed. First metasomal tergite
 (Fig. 1e) with fine transverse striations on antero-median part between latero-
 median carinae, medially rugulose ***khasianus***
- Legs entirely bright yellow except coxae (Figs 1c, 3). Fore femur with short
 longitudinal dark stripe on posterior surface (Fig. 1c). Epomia less developed.
 First metasomal tergite (Fig. 1d) without fine transverse striations on antero-
 median part, medially areolate-punctate..... ***flavicus* sp. n.**

Discussion

Because of their large bodies and long ovipositors, the genus *Dolichomitus* is one of the most conspicuous and well-known genera in the family Ichneumonidae. A considerable number of taxonomic and faunal studies have been published for several biogeographical regions (Townes and Townes 1960, Gupta and Tikar 1976, Gauld 1991, Sheng and Sun 2002, 2010, Zwakhals 2010, Choi et al. 2016) and plenty of distributional records are available. However, the *mandibularis* group is known only from the Himalayas, South-western China and Japan, and not recorded in other regions. This distribution suggests that the *mandibularis* group is one of the representatives of a Sino-Japanese element of insects and plants (Shirozu 1947).

The known hosts of the genus *Dolichomitus* are coleopteran borers of dead wood, mainly belonging to Cerambycidae, and species of Curculionidae and Melandryidae are also recorded as hosts (Townes and Townes 1960, Fitton et al. 1988, Gauld 1991). No host record is available for members of the *mandibularis* group. However, the observed oviposition behaviour of females of *Dolichomitus flavicus* sp. n., thrusting their ovipositors into dead *Pterocarya rhoifolia* trees, suggests that the host of this species is a borer of this tree. A cerambycid, *Chloridolum* (*Chloridolum*) *thaliodes* Bates is one of the most abundant species infesting dead or nearly dead *Pterocarya rhoifolia* at the collecting site. No other borers with enough biomass as a host for the larval development of such a large parasitoid as *D. flavicus* was found there, so *C. thaliodes* is the most plausible candidate for the host of *D. flavicus*, although confirmation is needed. In such a case, DNA barcode sequences of *D. flavicus* would be helpful in identification of larvae parasitizing the host.

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